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Productivity Analysis of Raisebore RB-50X for Raise Slot Drilling at Extraction level GBC PT. Freeport Indonesia

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Abstract

PT Freeport Indonesia is the largest gold and copper mine in Indonesia, located in Mimika Regency, Papua Province. In its operation, PT. Freeport Indonesia applies two mining systems, namely open pit mining and underground mining. Underground Mine at PT. Freeport Indonesia consists of DOZ, Big Gosan, DMLZ, Kucing Liar, and GBC, with one of the methods applied by PT. Freeport Indonesia is a block caving method. The Grasberg Block Cave mine has entered the production stage since September 2018, but in its operation the GBC Mine is still developing its operational area to meet production targets (development). The development cycle (cycle development), which is the main operation carried out, namely drilling and blasting, loading & transporting (mucking & hauling), primary support, and secondary support. To support the main operations, it is necessary to have main support consisting of access and area, ventilation, water and water, electricity, pull of tests, surveys, and dewatering. In the blasting process at the drawbell, one free face is needed which functions as the direction of rock collapsing in the blasting process on the drawbell. Making free face or commonly known as slot raise using a rasiebore machine from PT. Redpath for slot raise drilling. Meanwhile, in the drilling stage, the slot raise has a problem that has resulted in delays in the drilling process for the RB-50X raisebore tool. The impact of the delay in making the slot raise resulted in not achieving the production target due to a delay in the blasting process, where the blasting process in the drawbell area functions to break the rock so that it falls and can be transported to the crusher to enter the rock sizing process.

1. Introduction

PT. Freeport Indonesia carries out mining and processing activities for ore containing copper, gold and silver operating in areas with an altitude of 3300 to 4200 masl and underground mines at an altitude of 2510 to 3580 masl. In 2021, it is targeted that the main ore production will be produced from the Grasberg Block Cave (GBC) underground mine replacing the Grasberg Open Pit which will cease production. PTFI's underground mines are divided into several areas, namely Grasberg Block Caving (GBC), Deep Ore Zone (DOZ), Big Gossan, Deep Mill Level Zone (DMLZ), and Kucing Liar. The Grasberg Block Cave (GBC) underground mine is an underground mine with a total reserve of 874 million tons with gold reserves reaching 0.81 gram/ton. This makes GBC one of Freeport's underground mining blocks with large production achievements.

In the block caving method applied at GBC, there are 5 main levels to support the mining process, including the undercut level (2850), extraction level (2830), service level (2811), haulage level (2760), and drainage level (2710). . This study focuses on the Extraction level, which is an opening just below the undercut level. The function of the extraction level is as a place to withdraw broken ore from the undercut level. In this area there is a drawbell that functions to drain rock fragments resulting from blasting at the undercut level to the extraction by utilizing the force of gravity. Then the rock

fragments through the drawpoint withdrawal hole are loaded and transported by a loader to the loading point (ore pass) for further processing.

In the process of blasting at the drawbell, one free face is needed which serves as the direction of the rock collapse in the blasting process at the drawbell. Making a free face or what is commonly called a slot raise using a rasiebore machine from PT. Redpath for slot raise drilling activities. Meanwhile, in the drilling stage of making slot raises, there are problems that occur resulting in delays in the work drilling process of the RB-50X raisebore tool. The impact of the delay in making the slot raise resulted in not achieving the production target due to a delay in the blasting process, where the blasting process in the drawbell area serves to break the rock so that it falls and can be transported to the crusher to enter the rock sizing process.

The purpose of this research is to examine technically the working principle of the RB-50X raisebore tool operating in the GBC underground mine of PT. Freeport Indonesia is in the process of drilling a slot raise. In addition, analyzing the actual time the RB-50X raisebore tool is needed to complete one slot raise PT. Freeport Indonesia. As well as analyzing the obstacle factors that arise in the slot raise drilling process at PT. Freeport Indonesia.

2. Methodology

The research method used is quantitative method. Data collection was carried out at PT Freeport Indonesia (PTFI) by observing drilling activities. This activity aims to assess the time required to complete a slot raise and analyze the obstacle factors in drilling slot raises. The following are the stages carried out in the research:

Study of Literature

A literature study was conducted to obtain initial information regarding drawbell blasting slot drilling activities. This literature study collects literature information related to drilling theory and the drilling work area, namely at the extraction level.

Field Observations

Field observations are the first step in obtaining information in data collection with the aim of knowing firsthand the environment and working conditions of drawbell blasting slot drilling, stages of slot raise drilling with the RB-50X raisebore tool and getting an overview of the objectives of making drawbell blasting slots.

Data Collection

Data collection is carried out directly at the GBC underground mine site and refers to secondary data. Data retrieval depends on the type of data required, namely:

- Data regarding the supply of tools, the number of hours worked, the allocation of tools and their specifications, were obtained from reports in UG Engineering Cave Management, PT. Freeport Indonesia
- Geological data, lithology, topography, production targets, and other supporting data obtained from UG Cave Engineering Management, PT. Freeport Indonesi
- The tool cycle time data is obtained from observations and recordings in the field

3. Results

The Grasberg Block Caving (GBC) mine is located at level 2850 (undercut level), level 2830 (extraction level), 2810 (service level), 2760 (haulage level), 2730 (crasher level), 2700 (coveyor level), 2535 (terminal levels). In this research, the object of research is the Raisebor RB-50X drill. Research on this drill is to obtain drilling operational time and the time required to complete one slot raise.

3.1. Data Collection Location

Data retrieval is carried out at the Grasberg Block Caving (GBC) underground mine at extraction level 2830 at each drill slot raise at the drawpoint. The shape of the panels made has a cross section in the

form of a horse's tread with a standard size diameter of "D" panel measuring 4 m high and 4.4 m wide. at that location, the Raisebor RB-50X tool is used to make slot raises. The type of rock found in the field is diorite.

3.2. Data Return Time

The study took data, during the morning shift (day shift) and night shift (night night), following the crew from 07.00-15.00 to get data on the work of the Raisebor RB-50X drill bit on slot raise drilling at the drappoint

3.3. Working Area Condition

The working surface conditions in the drilling area in the north area tend to be wet and muck, making it difficult to carry out drilling activities. But in the South area, it tends to be dry (dry muck) so that it does not make it difficult for drilling operators, both at the time of drilling. Because the condition of the muddy area (wet muck) can potentially lead to landslides during the drilling process.

3.4. Vailability of Raisebor Drill Tool RB-50X

Data availability obtained from the calculation is the average productive working time of 3001 minutes or 50.01 hours. According to Eugene Plfeider (1972), the availability standard that is said to be good in general is availability which has a mechanical availability value of 80% which means that in every 112 hours of work, 89.6 hours of work can be used for production and 22.4 hours of work are lost for repairing equipment. . The actual availability of the Raisebor RB-50X in general from 14 shifts can be seen in Table 1

Tabel 1. Raisebor RB-50X Actual Availability

No.	Area	Availability %			
		MA	PA	UA	EU
1	P32/33 DB20	82,79	83,40	87,23	77,42
2	P31/32W DP37N	100	100	92,41	92,41
3	P27/28 DB19	87,12	87,58	76,52	82,73

4. Discussion

In assessing the availability of drill tools, there are 4 factors that need to be analyzed, including: Availability of tools, Physical condition, Availability of tool use, and Effective use. The study was carried out to determine the optimization of the use of tools during production. The following is an assessment of the availability of drill equipment at PT. Freeport Indonesia based on the factors that have been mentioned, including:

- Mechanical Availability
  Mechanical availability is a factor that indicates a tool that is ready to use from time lost due to repair or damage. The mechanical availability of PT Freeport Indonesia's Raisebor RB-50X drill bit is 79.35%, which means 20.65% of the drill is damaged, so repairs must be made.
- Ketersediaan Fisik
  Ketersediaan fisik merupakan prosentase kondisi fisik saat alat bor beroperasi. Kesediaan fisik mesin bor yang bekerja di PT Freeport Indonesia adalah 75.48%, yang berarti waktu yang hilang sebesar 20.52%. kondisi ini memberikan gambaran bahwa mesin bor bekerja secara efisien karena jumlah waktu yang hilang tidak menggagu kesiapan alat yang bekerja secara fisik.
- Use of Availability
  Use of Availabilityshows the percentage of time used when the tool operates according to predetermined working hours. The willingness to use drilling machines working at PT Freeport Indonesia is 75.80%. Meanwhile, standby time for drilling activities is 24.20%. this shows the tool is still functioning properly
- Efective Utilization
  Efective Utilization is the percentage of all available time which is then used for productive work. The efficiency of the tool can be known by looking at the percentage of this effective use. The

average effective use of drilling machines working at PT Freeport Indonesia is 75.80%, this indicates the physical condition of the tool is in good condition.

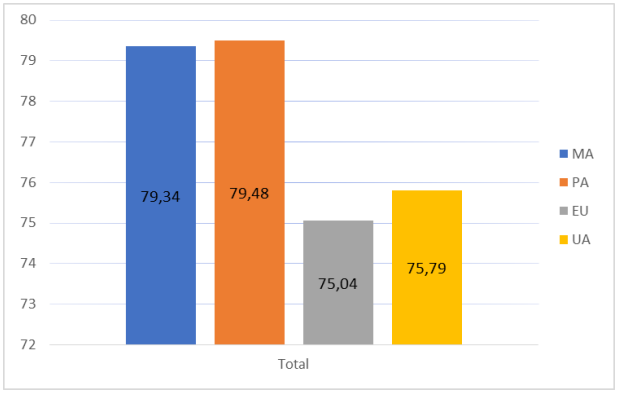

Figure 1. Availability chart of the Raisebor RB-50X bor drill tool

Work Efficiency

Drilling work efficiency is a factor that shows the percent of all time for 7 working days 12 shifts that can be used for productive work. From the calculation results obtained work efficiency value of.

Table 2. Work Efficiency

No.	Rig	Area	%
1	*Raisebor RB-50X*	P32/33W DP20N	50
2		P28/29 DP19E	74
3		P31/32W DP37N	54

5. Conclusion

Cycle time of the Raisebor RB-50X drill tool operating in the GBC underground mine of PT. Freeport Indonesia from setup to reaming is 5817 minutes or 96.95 hours or 6 days. The average actual operating hour of the Raisebor RB-50X is 7 days or 14 shifts or 112 hours. With the drill rate obtained is 87.56% (Very good). There are several obstacles that interfere with the process of making this slot raise, among others, frequent loss of water supply and water mine which causes drilling to be stopped, work must be delayed because work access is blocked by other crews with different job descriptions at the time of demobilization of drills to the next site.

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